

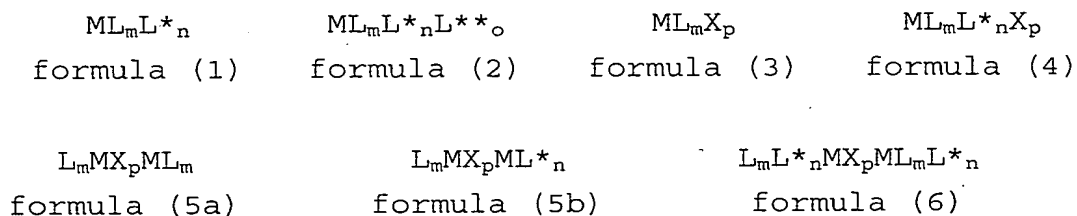
What is claimed is:

1. A process for forming carbon-metal bonds by ortho-metalation from a mixture of one or more organic compounds containing at least one C-H bond and at least one metal compound in a melt, suspension, dispersion, solution or in a supercritical medium, characterized in that microwave radiation acts on the mixture and that the reaction mixture is heated to at least 40°C.

2. The process as claimed in claim 1, characterized in that the reaction is carried out at from 100 to 210°C.

3. The process as claimed in claim 1 and/or 2 for preparing compounds of the formula (1), (2), (3), (4), (5a), (5b) and (6) according to scheme 1

Scheme 1:



in which:

M is a transition metal or a lanthanoid,

L, L*, L** are different ortho-metalated ligands,

X is the same or different at each instance and is an uncharged, anionic or cationic, monodentate or multidentate, bridging or chelating ligand,

m is 1, 2 or 3,

n is 0, 1 or 2,

o is 0 or 1, where $m + n + o = 2$ or 3 in each case,

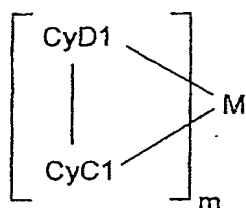
p is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12,

and where the partial structure ML_m is described by the formula (7), the partial structure ML^{*n} by the formula (8) and

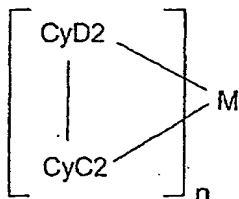
the partial structure ML**_o by the formula (9) according to scheme 2

Scheme 2:

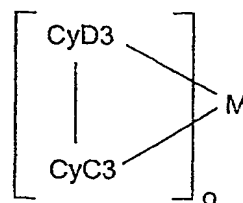
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formula (7)



formula (8)



formula (9)

10 in which:

CyD1, CyD2, CyD3 are each cyclic groups which may in turn bear one or more substituents R, containing, endocyclically or exocyclically, a donor atom D1, D2 and D3 via which the cyclic groups are bonded to the metal; the CyD1 and CyC1 groups, the
15 CyD2 and CyC2 groups, and the CyD3 and CyC3 groups are joined together via one or more covalent bonds,

CyC1, CyC2, CyC3 are each cyclic groups which may in turn bear one or more substituents R and each include a carbon atom via which the cyclic groups are bonded to the metal,

20 R are the same or different at each instance and are F, Cl, Br, I, NO₂, CN, a straight-chain, branched or cyclic alkyl or alkoxy group having from 1 to 20 carbon atoms, in which one or more nonadjacent CH₂ groups may be replaced by -O-, -S-, -NR¹-, -CONR²-, -CO-O-, -C=O-, -CH=CH- or -C≡C-, and in which one or
25 more hydrogen atoms may be replaced by F, or an aryl or heteroaryl group which has from 4 to 14 carbon atoms and may be substituted by one or more nonaromatic R radicals, and a plurality of substituents R, either on the same ring or on the two different rings, may together in turn form a mono- or
30 polycyclic, aliphatic or aromatic ring system,

R¹ and R² are the same or different and are each H or an aliphatic or aromatic hydrocarbon radical having 1 to 20 carbon atoms,

by reacting a metal compound M comp. with compounds of the formula (10a), (10b), (10c) according to scheme 3

Scheme 3:

CyD1



CyC1 - H

CyD2



CyC2 - H

CyD3



CyC3 - H

formula (10a)

formula (10b)

formula (10c)

in which the CyD1, CyD2, CyD3, CyC1, CyC2 and CyC3 radicals are each as defined under formula (7) to (9), characterized in that the reaction mixture is heated to at least 40°C and microwave radiation of frequency from 300 to 300 000 MHz acts on the mixture comprising the metal compound M comp. and the compounds of the formula (10a), (10b), (10c).

4. The process as claimed in one or more of claims 1 to 3, characterized in that the metals M used are preferably elements of atomic number from 39 to 79.

5. The process as claimed in claim 4, characterized in that the metals M used are the elements molybdenum, tungsten, rhenium, ruthenium, osmium, rhodium, iridium, palladium, platinum and gold.

6. The process as claimed in one or more of claims 1 to 5, characterized in that the metal compounds M comp. used are hydrated or anhydrous metal halides and/or halide-containing complexes and coordination compounds, or metal hydroxides, oxides or alkoxides, or metal β -ketoketonates and metal β -ketocarboxylates.

7. The process as claimed in one or more of claims 1 to 6,

characterized in that the donor atoms D1, D2 and D3 in the compounds of the formula (10a), (10b) and (10c) correspond to nitrogen, phosphorus, arsenic, antimony, bismuth, oxygen, sulfur, selenium or tellurium.

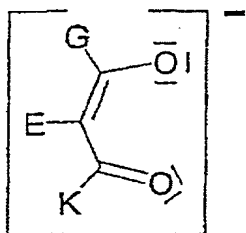
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8. The process as claimed in one or more of claims 1 to 7, characterized in that the ligands X are uncharged, anionic or cationic, monodentate ligands, multidentate bridging ligands or multidentate chelating ligands.

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9. The process as claimed in claim 8, characterized in that the ligands X are preferably acetylacetonates of the formula (11) according to scheme 5

15 Scheme 5



formula (11)

20

where:

K, G are the same or different at each instance and are a linear or branched alkyl group having 1-20 carbon atoms, in which one or more nonadjacent CH₂ groups may be replaced by -
 25 O-, -S-, -NR¹-, -CONR²-, -CO-O-, -CO-, -CH=CH- or -C≡C-, and in which one or more hydrogen atoms may be replaced by F or aromatic groups, or an aryl and/or heteroaryl group having 3-20 carbon atoms or an alkoxide OR¹,

E is the same or different at each instance and is a
 30 linear or branched alkyl group having 1-20 carbon atoms, in which one or more nonadjacent CH₂ groups may be replaced by -O-, -S-, -NR¹-, -CONR²-, -CO-O-, -CO-, -CH=CH- or -C≡C-, and in

which one or more hydrogen atoms may be replaced by F or aromatic groups, or an aryl and/or heteroaryl group having 3-20 carbon atoms,

R¹ is defined as described in claim 2.

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10. The process as claimed in one or more of claims 1 to 9, characterized in that microwave radiation of frequency from 500 to 10 000 MHz is used.

10 11. The process as claimed in one or more of claims 1 to 10, characterized in that the power used is from 1 watt per liter to 10 000 watts per liter.

15 12. The process as claimed in one or more of claims 1 to 11, characterized in that the microwave radiation is of the monomodal type.

20 13. The process as claimed in one or more of claims 1 to 12, characterized in that it is carried out by a continuous process or in a batchwise process.

25 14. The process as claimed in one or more of claims 1 to 13, characterized in that the C-H bond(s) is/are aryllic, vinylic and/or allylic C-H bond(s).

30 15. The process as claimed in one or more of claims 1 to 14, characterized in that the molar ratio of the metal compound to the compounds of the formula (10a), (10b), (10c) is from 1:1 to 1:20.

16. The process as claimed in claim 15, characterized in that the molar ratio of the metal compound to the compounds of the formula (10a), (10b), (10c) is from 1:6 to 1:12.